THE UNIVERSITY OF CHICAGO MEDICINE & BIOLOGICAL SCIENCES

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TO: UCM Medical Staff, Housestaff, Nursing Staff, and Patient Care Centers

FROM:

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RE: Updated Blood Gas Reference Ranges and Co-Oximetry Reporting

Starting February 5th, 2020, the Rapid Response Laboratory (Central Clinical Laboratories) and the Respiratory Care Laboratory in Comer (NICU Lab K239) will report the complete co-oximetry panel with every blood gas order. Additionally, reference ranges for mixed venous[1], cord[1,2], and capillary[3] blood gas tests will be updated. These updates are expected to be phased in over a period of two weeks.

This co-oximetry panel consist of:

- SO_2 (%): measured oxygen saturation of ***functional*** hemoglobin (*i.e.* O_2Hb and HHb)
- Total Hemoglobin (tHb, g/dL)
- % Oxyhemoglobin (O_2Hb): measured oxygen saturation of ***total*** hemoglobin
- % Deoxyhemoglobin (HHb): deoxygenated hemoglobin
- % Carboxyhemoglobin (COHb): a stable complex of carbon monoxide and hemoglobin
- % Methemoglobin (MetHb): hemoglobin with iron in the Fe^{3+} state not able to bind oxygen

O_2Hb, HHb, COHb, MetHb are reported as % of *total* hemoglobin and add up to 100%.

Definitions[4]:

- SO_2 (%) = $\dfrac{c\mathrm{O_2Hb}}{[c\mathrm{O_2Hb} + c\mathrm{HHb}]} \times 100$

- % Oxyhemoglobin = $\dfrac{c\mathrm{O_2Hb}}{[c\mathrm{O_2Hb} + c\mathrm{HHb} + c\mathrm{COHb} + c\mathrm{MetHb}]} \times 100$

Please note that:

1) SO_2 is the measured oxygen saturation of *functional* hemoglobin (O_2Hb and HHb) and it does *not* account for the presence of dyshemoglobins like COHb and MetHb.
2) In the absence of dyshemoglobins, SO_2 (as determined by pulse oximetry or co-oximetry) should be equal to % oxyhemoglobin. In the presence of elevated COHb or MetHb, the % oxyhemoglobin will be significantly decreased in comparison to SO_2. In such a situation (*e.g.* severe CO poisoning), the SO_2 typically will be within normal limits while the O_2 content may be severely decreased leading to potentially fatal outcomes if not recognized.
3) Thus, it is important to review the complete co-oximetry panel and not just the SO_2 result.

If you have any questions, please contact Dr. van Wijk by email at xvanwijk@bsd.uchicago.edu or by phone at 773-702-2806.

References

1) Contemporary Practice in Clinical Chemistry, 3rd Ed. ISBN 9781594251894. Pg 450-463.
2) B. Fouse: Reference range evaluation for cord blood gas parameters. Available at https://acutecaretesting.org/en/articles/reference-range-evaluation-for-cord-blood-gas-parameters
3) Cousineau J *et al*. Clinical Biochemistry 2005;38:905-907
4) Haymond S *et al*. Clin Chem 2005;51:434-444